

## **FLAME CAP KILNS FOR HAZARDOUS FUELS REDUCTION AND BIOCHAR APPLICATION IN THE WESTERN UNITED STATES**

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Forest managers use hazardous fuels treatments to reduce the severity and intensity of wildland fire. Forest managers commonly pile and burn forest residues, an inexpensive approach to treating hazardous fuels. Fire danger and air quality restrictions increasingly limit the ability of forest managers to burn piles of forest residue. Further, pile burning often consumes organic soils and reduces future productivity of forest stands. A novel approach to this challenge is the use of low cost flame-cap biochar kilns to reduce hazardous fuels while making biochar in forest settings from excess woody biomass. A primary benefit of this approach is accessibility; almost anyone can do it, often with materials and equipment on hand. This method allows for small-scale biochar production across a wide variety of uses and users. Instead of open pile burning of forest residues, we put the fire in a box, or a flame-cap kiln, which reduces damage to the soil and protects air quality. We apply a fraction of the biochar on-site while a portion is available for application on nearby agricultural lands. This reduces wildland fire hazard by converting forest residues into biochar, and the addition of biochar to the soil can increase the drought tolerance of remaining vegetation.

The Utah Biomass Resources Group (UBRG) conducted seven hands-on kiln workshops in Utah with more than 200 attendees. We have successfully pyrolyzed five different forest feedstock types including two invasive tree species. By creating methods for biochar production that land managers can easily access, the use of biochar can grow, which may lead to increased carbon sequestration, increased soil productivity, and improved air quality.

While these small-scale kilns have reduced hazardous fuels by approximately 20 semi-truck loads, the UBRG is scaling-up this approach to increase the pace and scale of hazardous fuels reduction by these methods. The UBRG recently received a Public Lands Initiative Grant to scale up this approach from kilns that measure 1.5 meters across, to kilns that are six meters across. Parallel efforts are ongoing in Oregon, Nevada, and North Dakota using a variety of kiln designs that depend on repurposed local materials; this is an important regional development in biochar production.

Other important benefits of this approach include the cost reduction of feedstock preparation by avoiding the expense and energy necessary for chipping and/or grinding feedstock material. We safely deployed these kilns in close proximity to heavy fuels loads, urban infrastructure, homes, and ecologically sensitive locations such as within Stream Management Zones.

Meanwhile, the UBRG is testing the efficacy of using locally produced biochars as an animal feed amendment by investigating the behavioral and physiological response of sheep when given access to biochar. Humans use activated carbon to ease ingestion and as a poisoning antidote. Biochar can enhance the efficiency of nutrient utilization, reduce environmental impacts, increase rates of detoxification, and reduce the presence of xenobiotics to promote animal health, welfare, and productivity. This research fills a knowledge gap regarding how locally produced biochars influence animal performance.